



ABSTRACT OF THE DISCLOSURE

[ABSTRACT]

A digital still camera includes means for converting an optical image into a digital electronic signal indicative of a still image; means for receiving an electromagnetic signal formalized in accordance with a wireless telephone system; means for modifying the electromagnetic signal into digital electronic signal indicative of a still image; means for alternatively displaying a still image on the basis of the digital electronic signal form the converting means or the modifying means; and means for controlling the displaying means in a first mode in response to a first type of the electromagnetic signal containing a still image signal and in second mode in response to a second type of the electromagnetic signal containing a still image signal.

[REPRESENTATIVE DRAWING]

Fig. 3

[SPECIFICATION]

[TITLE OF THE INVENTION]

DIGITAL STILL CAMERA OF TELECOMMUNICATION

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[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 represents a perspective view of an embodiment of a digital still camera according to the present invention;

FIG. 2 represents a block diagram showing an embodiment of the digital still camera according to the present invention; and

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FIG. 3 represents a concept diagram showing an operation of the digital still camera according to an embodiment of the present invention.

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

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[DESCRIPTION OF THE RELATED ART]

The present invention relates to a digital still camera which converts an optical image into a digital electronic signal representative of the image and stores the digital electronic signal, and more particularly to a digital still camera capable of telecommunication by means of an electromagnetic signal formalized in accordance with a wireless telephone system.

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In the field of digital still cameras, various types of communication of digital electronic image signals have been proposed. One of the typical proposals is to transmit the digital electronic image signal to a remote device, such as a computer, by connecting a digital still camera to a wireless telephone through a MODEM, and transmitting the signal to the remote device that is connected to a telephone line.

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Japanese Laid Open Patent Application Nos. 6-133081 and 6-268582 respectively disclose a digital still camera and a wireless telephone contained in a single housing. The purpose of combining the digital still camera and the wireless telephone in one inseparable housing is to conserve memory to store the digital electronic image signals. In other words, the digital electronic image signals are transmitted from the digital still camera to a computer at a remote site with a large memory.

Such digital image signals would otherwise have to be stored in a memory device included in the digital still camera itself. Thus, the digital still camera can successively take and store a great numbers of shots without a large capacity memory device included in the digital still camera itself, which would be advantageous to design a small size and low price digital still camera.

The device disclosed in Japanese Laid Open Patent Application NO. 6-133081 or No. 6-268582, which transmits image information taken by a digital still camera to a computer at a remote site, has disadvantages because the system is not able to receive image information from a remote site. Furthermore, the device is expensive and inconvenient because a large amount of memory is required and it takes long to transmit image pixel data per frame as it is or in compressed format.

[SUBJECT MATTER OF THE INVENTION]

An object of the present invention is to provide a digital still camera including in one inseparable housing a wireless telephone, which can receive and display a digital electronic image signal generated by another digital still

camera.

In other words, the digital still camera provided by the present invention as a device prepared for receiving digital electronic signal indicative of a still image taken by another remote digital still camera is not necessarily a device with a large capacity memory device included therein.

Another object of the present invention is to provide a digital still camera capable of telecommunication, in which a user can not only talk in the ordinary manner, but also may view a displayed still image.

Another object of the present invention is to provide a digital still camera which can communicate with various remote devices including a standard computer.

Another object of the present invention is to provide a digital still camera which can efficiently communicate with digital still cameras.

[ELEMENTS AND WORKING EXAMPLES OF THE INVENTION]

In order to obtain these objects, a digital still camera according to the present invention includes:

means for converting an optical image into a digital electronic signal indicative of a still image;

means for receiving an electromagnetic signal formalized in accordance with a wireless telephone system;

means for modifying the electromagnetic signal into digital electronic signal indicative of a still image;

means for alternatively displaying a still image on the basis of the digital electronic signal from the converting means or the modifying means; and

means for controlling the displaying means in a first mode in response to a first type of the electromagnetic signal containing a still image signal and in second mode in response to a second type of the electromagnetic signal containing a still image signal.

5 The above objects and features of the present invention will be apparent from the following description of the preferred embodiments with reference to the accompanying drawings.

FIG. 1 represents a perspective view of an embodiment of a digital still camera according to the present invention;

10 FIG. 2 represents a block diagram showing an embodiment of the digital still camera according to the present invention; and

FIG. 3 represents a concept diagram showing an operation of the digital still camera according to an embodiment of the present invention.

15 As shown in Fig. 1, a digital still camera according to an embodiment of the present invention includes a microphone 2 and a speaker 3 in a single housing.

Further, the digital still camera includes a display device (color liquid crystal device) 4 of a reflection type without back light illumination to save electric power, which displays a color image of 60,000 pixels. A touch panel is
20 formed to function as dial buttons for the digital telephone at the display device 4.

A camera lens 5 can rotate and is normally directed in the direction represented by arrow D. In other words, the camera lens 5 is normally directed toward an object located at a position where the display device 4 is not

observable and is alternatively capable of being directed toward an object located at a position where display device 4 is observable as shown by the broken line in FIG. 1

5 The speaker 3 and the microphone 2 can function in a close mode or in a remote mode. In a close mode, the users put their ears and mouth close to the speaker 3 and microphone 2. In a remote mode, the users can put their ears and mouth relatively remote from the speaker 3 and the microphone 2.

10 A manual switch 6 activates the display device 4 "ON" to display a still image. The speaker 3 and the microphone 2 are automatically changed into a remote mode when the display device 4 is activated by the manual switch 6.

An image receiving request switch 7 is activated to request an image in manual mode. A pen input touch panel 4 is also formed to input an image by a pen when an input switch 8 is activated. The button 9 is a shutter release button.

15 In FIG. 2, a thick line represents the flow of information and a thin line represents the flow of control signals.

In more detail, as shown in FIG. 2, the digital still camera according to an embodiment of the present invention includes

20 a CCD camera 10 for converting an optical image into a digital electronic signal,

a transmitting/receiving exchanger 11 for receiving or transmitting an electromagnetic signal representing an image,

a demodulator 12 for demodulating the received electromagnetic signal, which is connected to the output of the transmitting/receiving exchanger 11,

an A/D converter 13 for converting the electromagnetic signal into a digital electronic image signal,

a switching unit 15 connected to the output of the A/D converter 13,

an extracting unit 22 for extracting a still image signal component and a voice signal component from the digital electronic signal,

a memory 14 for storing the still image signal from the extracting unit 22 or the digital still image signal from the CCD camera 10,

a speaker 3 for generating an audio signal in response to the electromagnetic signal received by the transmitting/receiving exchanger 11,

a first mode changing unit 18 for activating the speaker 3 in the first/second mode;

a first distinction unit 16 for distinguishing a still image signal from the electromagnetic signal containing an audio signal to thereby automatically control the switching unit 15 from a first mode to a second mode;

a display control unit 20 for controlling the display device 4 to display whether the received electromagnetic signal contains a still image signal or audio signal,

a first inhibition unit 17 for turning the first mode changing unit 18 "OFF" to restrain the speaker 3 from generating a voice signal in the second mode,

an image receiving request switch 7 for operating the switching unit 15 from a first mode to a second mode,

a telephone number receiving unit 38 for receiving a telephone number signal from another remote device, such as another digital still camera or a

telephone, and

an answer back receiving unit 40 for receiving a second answer back signal from another remote device.

In addition to the above-mentioned construction for receiving an
5 electromagnetic signal from the remote device and outputting a corresponding voice signal and displaying a corresponding image, the digital still camera according to an embodiment of the present invention further includes:

a microphone 2 for converting sound into an electronic audio signal

a second mode changing unit 21 for activating the microphone 2 in a

10 first/second mode,

a first modification unit 41 for forming a still image signal of fewer pixels than the still image signal input from the memory 14,

a combination unit 23 for combining the electronic audio signal from the second mode changing unit 21 and the still image signal from the first

15 modification unit 41,

a first mixing unit 34 for mixing the still image signal from the first modification unit 41 and a signal input by pen when an input switch 8 is activated "ON",

a selecting unit 24 for outputting alternatively one of the signals from
20 the combination unit 23 and from the first mixing unit 34,

a dial 28 for dialing a telephone number designating another remote device,

a telephone number memory 29 for storing telephone numbers,

a first comparator 30 and second comparator 47 for comparing the

telephone number dialed by the dial 28 with the telephone number stored in the memory 14,

a second inhibition unit 31 for inhibiting the combination unit 23 from combining the electronic audio signal from the second close/remote mode exchanger 21 and the still image signal from the first modification unit 41 when
5 the dialed telephone number designating another remote device coincides with the memorized telephone number stored in memory 14,

a control unit 43 for controlling the first modification unit 41,

a second modification unit 35 for judging whether the still image signal
10 stored in memory 14 is a first type or a second type,

an answer back transmitting unit 39 for generating a first answer back signal indicative of receiving an electromagnetic signal transmitted from another remote device,

a second mixing unit 25 for mixing signals from the selecting unit 24,
15 the answer back transmitting unit 39, and the dial 28,

a D/A converter 26 for converting the signal from the second mixing unit 25 into an analog signal,

a modulation unit 27 for modulating the signal from the D/A converter 26 and outputting it to the transmitting/receiving exchanger 11, and

20 an image transmitting request switch 32 connected to the input of the second inhibition unit 31.

The first modification unit 41 includes a first reducing unit 42 for reducing the number of pixels of the still image signal input from memory 14.

The second modification unit 35 includes a second distinction unit 37 for

judging whether the image signal input from the memory 14 is of a first type or a second type, and a second reducing unit 36 for reducing the number of pixels of the image signal input from memory 14 according to the results and outputting the image to the display device 4.

5 The digital still camera according to an embodiment of the present invention further includes an input/output interface unit 44 for outputting an image signal from a card to the memory 14 and a memory card 46.

 The transmitting/receiving exchanger 11 is able to amplify the transmitted or received electromagnetic signals as well as transmit those
10 signals.

 The following is a summary of the relationship among the sizes of a still image signal processed by the CCD camera 10, the memory 4, and the display device 4. The size i.e., the number of pixels of the still image per frame processed by the CCD camera 10 or the memory 14 is 240,000, which is
15 greater than 60,000 pixels of the still image signal contained in the first type of electromagnetic signal.

 The number of pixels of the still image signal per frame processed by the display device 4 is 60,000, which is substantially equal to that of the still image signal contained in the first type of electromagnetic signal.

20 On the other hand, the number of pixels of the still image signal per one frame processed by the CCD camera 10 is 240,000, which is substantially equal to that of the still image signal contained in the second type of the electromagnetic signal.

 One feature of the present invention is that the number of pixels of the

still image signal per one frame is reduced from 240,000 to 60,000 pixels when it is transmitted and received only for the purpose of displaying the image on the display device 4 of 60,000 pixels. This saves time necessary for the digital still camera to exchange one frame of a still image signal with the same type of the digital still camera.

Display device 4 is capable of alternatively displaying a still image of the first type of electromagnetic signal or the second type of electromagnetic signal received from a remote device.

The input/output interface 44 serves as a means for outputting the digital electromagnetic signal from the memory 14, the number of pixels of the still image per frame taken out being 240,000 pixels which is greater than that of the still image signal contained in the first type of the electromagnetic signal, i.e., 60,000 pixels.

The memory card 46 also serves as a means for outputting the digital electronic signal from the memory 14, the number of pixels of the still image per one frame taken out being also 240,000 pixels which is greater than that of the still image signal contained in the first type of electromagnetic signal, i.e., 60,000 pixels. The memory card 46 serves as a memory for storing the still image of 240,000 pixels per frame and is detachably inserted into the digital still camera. In order words, a slot for memory card 46 serves as a means for removing the digital still image memory out of the digital still camera.

The above-mentioned operation of the digital still camera according to embodiments of the present invention will be explained in detail.

First, the operation which electromagnetic image signals formalized in

accordance with the wireless telephone system are received and displayed and the operation which electronic voice signals formalized in accordance with the wireless telephone system are received and outputted are explained.

5 An antenna of the digital still camera of the present invention receives an electromagnetic signal from another remote device, such as another digital still camera, and a transmitting/receiving exchanger 11 outputs the received electromagnetic signal to a demodulator 12 in a receiving mode.

The demodulator 12 demodulates the electromagnetic signal and an A/D converter 13 converts the demodulated electromagnetic signal into a digital electronic signal. The digital electronic signal is inputted to an extracting unit 22
10 and the extracting unit 22 extracts a voice signal component and an image signal component from the signal.

The voice signal is inputted to a first mode changing unit 18 and the image signal is inputted to a memory 14. In that case the digital signal from
15 the A/D converter 13 is also inputted to a first distinction unit 16,

The first distinction unit 16 distinguishes a still image signal from the digital electronic signal containing an audio signal to thereby automatically control a switching unit 15 from first mode to second mode and output a corresponding control signal to a first inhibition unit 17.

20 The switching unit 15 is provided to switch between a first mode and a second mode, the first mode for generating audio by a speaker 3 and the second mode for displaying a still image on a display device 4 responsive to the digital signal received.

The first answer back signal indicates that the digital still camera is

capable of receiving a first type of electromagnetic signal containing a still image signal of 60,000 pixels per one frame.

The telephone number receiving unit 38 automatically activates the digital still camera of the present invention to receive a transmitted signal responsive to the telephone number as an electromagnetic signal.

The signal from the A/D converter 13 is input to a switching unit 15 and a first distinction unit 16, respectively after the electromagnetic signal containing a still image signal from the remote device is transmitted and is processed, as described above.

The first distinction unit 16 distinguishes a still image signal from the digital electronic signal containing an audio signal to thereby automatically control a switching unit 15 from first mode to second mode and output a corresponding control signal to a first inhibition unit 17.

The switching unit 15 outputs the digital electronic signal from the A/D converter to a memory 14 in second mode while a first inhibition unit sets a first mode changing unit 18 "OFF" to restrain the speaker 3 from generating an audio signal in the second mode.

The digital electronic signal containing a still image signal input from the switching unit 15 to the memory 14 is output to a display device 4 through a second modification unit 35. A second distinction unit 37 of the second modification unit 35 judges whether the still image signal is of a first type or a second type and outputs a control signal corresponding to a judgment result to a second reducing unit 36. The number of pixels of the displays device 4 is 60,000. In other words, the second distinction unit 37 activates the reducing

unit 36 to coincide a number of pixels of the still image signal with that of the display device 4.

In order words, when the received still image signal is of a first type, the number of pixels of the received still image signal is equal to that of the display device 4, so that the second distinction unit37 sets the second reducing unit 36
5 "OFF". Thus, the received still image signal from the memory 14 is passed through the second reducing unit 36 as it is with the number of pixels not reduced.

On the other hand, when the received still image signal is of a second
10 type, the number of pixels of the received still image signal is greater than that of the display device 4, so that the distinction unit37 sets the second reducing unit 36 "ON". Thus, the received still image signal from the memory 14 is passed through the second reducing unit 36 with the number of pixels reduced from 240,000 to 60,000.

15 The first distinction unit 16 activates the switching unit 15 to a second mode and outputs a control signal to a display device 4 to indicate on it with characters or symbols whether the received electromagnetic signal contains a still image signal or a voice signal .

An example of talking on the phone while watching an image on display
20 device 4 is the case where a still image is transmitted during voice signal transmission. In this case, a combination of digital electronic signals indicative of a still image and the electronic audio signal is received as an electromagnetic signal.

When an electromagnetic signal containing a still image signal and an

audio signal is received. The extracting unit 22 extracts an audio signal component from the combination signal containing both a still image signal and an audio signal and outputs the audio signal to the first mode changing unit 17, so that the audio signal is outputted through a speaker 3.

5 The first distinction unit 16 activates the switching unit to a first mode and control the first inhibition unit 17 to sets the first mode changing unit 18 "ON".

 The display device 4 is "ON", so that the first mode changing unit 18, the second mode changing unit 21, speaker 3 and microphone 2 are set a
10 close mode which an audio signal form another digital still camera is received into a remote mode which an audio signal is transmitted to another digital still camera.

 The first mode changing unit 18 is set to the remote mode, so that audio signal form the extraction unit 22 is input to the speaker 3 through the
15 first mode changing unit 18. As a result, the audio signal is output by a speaker 3. Accordingly, display device 4 is capable of displaying the received still image while the audio signal is generated from the speaker 3, so that the user of the digital still camera can see a still image and hear a voice from a remote device.

20 When the user speaks a message, the message is converted to an electronic audio signal through a microphone 2 and is input to a second mode changing unit 21. The second mode changing unit 21 outputs the electronic audio signal to a combination unit 23 and the electronic audio signal is transmitted to another telephone by the transmitting/receiving exchanger 11

through the D/A converter 26 and the modulator 27.

The combination unit 23 is capable of combining a digital still image signal received by a CCD camera while the audio signal is transmitted, so that the audio signal and the still image signal can be transmitted at the same time.

5 The user of the digital still camera designates a telephone number of a remote device, such as a telephone, by activating a dial 28, which is formed as a touch panel in display device 4. The dialed telephone number is transmitted to a corresponding remote device by transmitting/receiving exchanger 11 through a second mixing unit 25, D/A converter 26 and a modulator 27 as an
10 electromagnetic signal.

The first comparator 30 compares the dialed telephone number with a telephone number stored in a telephone number memory 29 and outputs a comparison result to a second inhibition unit 31.

15 The phone number memory 29 stores at least one telephone number of a remote device.

20 The second inhibition unit 31 inhibits the combining unit 23 from combining the electronic audio signal with a digital still image signal when the dialed telephone number designating a remote device coincides with the stored telephone number in the telephone number memory 29. In this case, the second inhibition unit 31 controls a selecting unit 24 so as not to select and output a still image signal.

The selecting unit 24 which selects one of the received audio signal and a digital signal indicating a still image selects and outputs signal from the combining unit 23 and the first mixing unit 34.

The signal from the selecting unit 24 is transmitted to an electromagnetic signal formalized in accordance with a wireless telephone system through D/A converter 26, modulator 27 and transmitting/receiving exchanger 11.

5 However, the second inhibition unit 31 controls a selecting unit 24 so as to select and output a still image signal when an image transmitting request switch 7 is activated.

 In other words, if the user selects an image transmission by activating the image transmitting request switch 7 when a character or symbol indicating a still image signal is displayed on the display device 4, the second inhibition
10 unit 31 controls a selecting unit 24 so as to select and output a still image signal.

 Accordingly, only when the image transmitting request switch 7 is activated and the dialed telephone number coincides with the telephone
15 number stored in the telephone memory 29.

 The telephone number memory stores at least a telephone number of a remote device capable of receiving a digital still image signal. The remote device capable of receiving a digital still image signal calls a second remote device.

20 The first comparator 30 compares the dialed telephone number with the telephone number of the second remote device and outputs a comparison result to a second inhibition unit 31. The second inhibition unit 31 allows the combining unit 23 to combine the electronic audio signal with a digital still image signal when the dialed telephone number designates a remote device

coincides with the telephone number of the second remote device. In this case, the second inhibition unit 31 controls a selecting unit 24 so as to select and output a still image signal.

5 As the above-described, the Combination of the electronic audio signal with a digital still image signal and the selection are allowed when the dialed telephone number designating a remote device coincides with the telephone number of the second remote device.

10 The phone number receiving unit 38 activates the digital still camera to receive the signal transmitted from another digital still camera in response to the electromagnetic signal formalized in accordance with the wireless phone system.

the answer back unit 39 outputs the answer back signal according to the signal from the phone number receiving unit 38 and the the answer back signal is transmitted the second mixing unit 25, D/A converter 26, modulator 27 and the transmitting/receiving exchanger 11.

20 The answer back signal is for identifying the digital still camera for receiving the electromagnetic signal containing a still image signal of 60,000 pixels per frame. Another digital still camera transmitting of the identifying electromagnetic signal will further transmit the electromagnetic signal containing a still image signal of 60,000 pixels per frame in less time than that necessary for a still image signal of 240,000 pixels per frame.

In this case, the answer back receiving unit 40 functions and outputs a corresponding signal to the control unit 43. The control unit 43 activates a first modification unit 41 to reduce the number of pixels of a still image signal from

the memory 14 when the second answer back signal is transmitted by the answer back receiving unit 40.

The first reducing unit 42 reduces the number of pixels of the still image from memory 14 to form a still image signal of fewer pixels to be contained in the transmitted electromagnetic signal and further reduces the time of transmitting one frame of the still image signal by reducing the number of pixels. In other words, a still image signal of 240,000 pixels at memory 14 is modified into a still image signal of 60,000 pixels per frame with a shorter transmission time.

The first reducing unit 42 is inoperative when the answer back receiving unit 40 fails to receive the second answer back signal transmitted from the designated remote device, whereby the first modification unit 41 forms a still image signal to be contained in the electromagnetic signal without reducing the number of pixels of the still image signal from memory 14.

The still image signal from the first reducing unit 42 is output to a first mixing unit 34, and the first mixing unit mixes the still image signal with a pen input signal according to an operation of switch 8, so that the still image signal mixed with the pen input signal is transmitted to another digital still camera by the transmitting/receiving exchanger 11 through a second mixing unit 25, a D/A converter 26, and a modulation unit 27.

The telephone number memory stores a plurality of phone numbers, the phone number being classified into a first group and a second group. The first group is for a telephone number of a remote device having no function of receiving the digital electromagnetic signal, and the second group is for a

telephone number of a remote device having function of receiving the digital electromagnetic signal.

The second group is further classified into a first subgroup and a second subgroup, the first subgroup being for a remote device for receiving the first type of the electromagnetic signal containing a still image signal of 60,000 pixels per frame, while the second subgroup being for a remote device for receiving the second type of the electromagnetic signal containing a still image signal of 240,000 pixels per frame.

The second comparator 47 compares the dialed telephone number with the telephone number stored in the telephone memory 29. The first reducing unit 42 reduces the number of pixels of the still image from memory 14 according to the comparison result.

As mentioned above, the number of pixels of a still image signal to be transmitted is reduced or is not reduced according to an image signal processing capacity of a remote device which the still image signal from a CCD camera or an input/output interface 44 or memory card 46 will be transmitted, and the number of pixels of a still image signal is reduced or is not reduced according to an image signal processing capacity of a digital still camera receiving the still image signal from a remote device, thus the digital still camera can communicate with another remote device, such as another CCD camera or computer.

[EFFECT OF THE INVENTION]

As described above, the present invention, in accordance with the embodiment, provide a digital still camera capable of telecommunication

including in one inseparable housing a wireless handy phone, which can receive and display a digital electronic signal indicative of a still image taken by another digital still camera.

Also, the present invention provides a digital still camera which can
5 suitably receive the audio signal and the image signal without any confusion and a user can talk not only in the ordinary manner, but also with the displayed still image being watched.

Also, the present invention provides a digital still camera which can communicate both the audio signal and the image signal at the same time and
10 can communicate with various types of telephones including one having no function of receiving an image signal and can communicate with the same type of digital still camera.

WHAT IS CLAIMED IS:

1. A digital still camera capable of a telecommunication

comprising:

means for converting an optical image into a digital electronic signal

5 indicative of a still image;

means for receiving an electromagnetic signal formalized in accordance
with a wireless telephone system;

means for modifying the electromagnetic signal into digital electronic
signal indicative of a still image;

10 means for alternatively displaying a still image on the basis of the digital
electronic signal from the converting means or the modifying means; and

means for controlling the displaying means in a first mode in response
to a first type of the electromagnetic signal containing a still image signal and in
second mode in response to a second type of the electromagnetic signal

15 containing a still image signal.

2. The digital still camera of claim 1, wherein the first type of the
electromagnetic signal containing a still image signal of a less number of pixels
than that of the still image signal contained in the second type of the
electromagnetic signal.

20 3. The digital still camera of claim 2, wherein the first type of the
electromagnetic signal containing a still image signal is of a less time of
transmitting one frame than that of the still image signal contained in the
second type of the electromagnetic signal.

4. The digital still camera of claim 2, wherein the controlling

means includes means for reducing the number of pixels of the still image signal in the second mode.

5 5. The digital still camera of claim 4, wherein the pixel of the displaying means is less than that of the still image signal contained in the second type of the electromagnetic signal .

6. The digital still camera of claim 5, wherein the pixel of the displaying means is substantially equal to that of the still image signal contained in the first type of the electromagnetic signal.

10 7. The digital still camera of claim 1, further comprising means for distinguishing the first type of the electromagnetic signal from the second type of the electromagnetic signal and means responsive to the distinguish means for switching the controlling means between the first mode and the second mode.